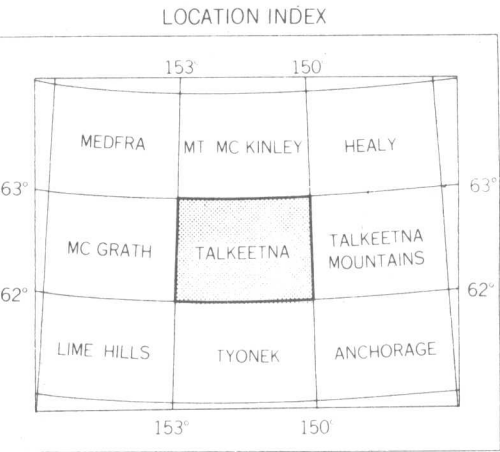


BASE FROM U.S. GEOLOGICAL SURVEY, 1954

SCALE 1:250,000

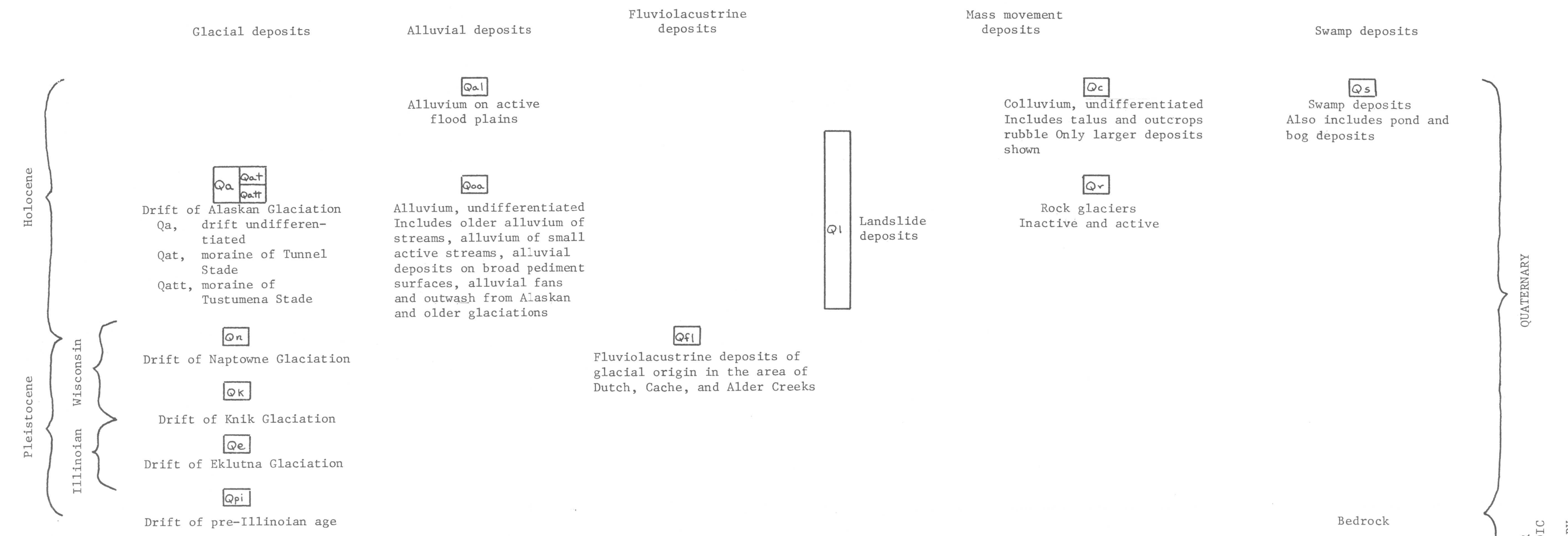
EXPLANATION OF MAP SYMBOLS

- Contact separating surficial deposits and bedrock and surficial deposits. Dashed where poorly preserved.
- End and lateral moraine marking maximum position of each of the Pleistocene glaciations. Dashed where poorly preserved.
- End, lateral and medial moraines of the recognized Neptome advances; numbered I, oldest to IV, youngest. Dashed where poorly preserved or inferred.
- Undifferentiated end and lateral moraines of the Eklutna glaciation.
- Recessional moraine and major still-stands; barbs point toward former glacier. Dashed where preserved or inferred.
- Fault cutting surficial deposits. Dashed where uncertain or poorly exposed.



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DESCRIPTION OF GEOLOGIC UNITS

- DRIFT OF ALASKAN GLACIATION**
Glacial deposits of Holocene age primarily occur at higher altitudes in the Alaska Range where post-Pleistocene climatic conditions were favorable for glacial advances. Karlstrom (1957) named this glacial advance the Alaskan Glaciation and subsequently subdivided it into the Tustumena and Tunnel Stages. Karlstrom (1964) has shown that the Tustumena Stage began about 4,500-4,800 years ago, and the Tunnel Stage lasted from about 1,200 to about 200 years ago. Glaciers of the Tustumena Stage were more extensive than those of the Tunnel Stage. Present-day glaciers in this part of Alaska are remnants of the Alaskan Glaciation.
In the Talkeetna quadrangle, alpine-valley glaciers have formed two distinct and moraine sequences that correspond to the Holocene advances that Karlstrom recognized on the east side of the Cook Inlet. There is little difference in the appearance of moraines of the two stages of the Alaskan Glaciation; both are fresh and unmodified and contain angular rock fragments. A few moraines of the Tustumena Stage have been covered, but not by above timberline. Where the Alaskan Glaciation is indicated by only one set of fresh moraines, they are mapped as undifferentiated deposits.
Measurements made on aerial photographs indicate that the distances from present-day ice fronts to end moraines of the Tustumena Stage range from 0.96 km to 2.4 km and average 1.6 km. Glacial measurements for end moraines of the Tunnel Stage range from 0.48 km to 0.96 km and average 0.6 km (based on 13 measurements).
Two small landlides, one on a tributary to the Yentna Glacier (T. 23 N., R. 13 W.) and the other on the Yentna Glacier (T. 23 N., R. 13 W.), were observed on aerial photographs taken in July 1953 and 1957, respectively. The location of these landlides on the Yentna and Yentna glaciers in 1976 indicates an average rate of glacial movement of 36 m per year and 32 m, respectively.

- DRIFT OF NEPTOME GLACIATION**
Glacial deposits of late Wisconsin age include end, lateral and ground moraines that, on the basis of morphology and number of indicated advances correlate with moraines of the Neptome Glaciation in the Kenai Peninsula (Karlstrom, 1964). The Brooks Lake Glaciation in the Iliamna Lake area (Karlstrom and Reed, 1973) and the Farewell Bend Glaciation on the north side of the Alaska Range (Karlstrom and others, 1964). Radiocarbon dates of moraines on the Kenai Peninsula have placed the lower boundary of Neptome Glaciation between 46,000 and 37,000 years ago and the upper boundary at 3,500 years ago (Karlstrom, 1964).
Drift of the Neptome Glaciation is most extensive on the south side of the Alaska Range. Early during the glaciation large valley glaciers filled the present-day valleys of the Yentna, Kullikina, Chulitna and Sustina Rivers and coalesced in the lowland areas, forming a broad glacial front extending 40 km into the north-eastern half of the Talkeetna quadrangle. On the north side of the Alaska Range Neptome deposits are much less extensive due to the barrier effect of the Alaska Range to moisture coming from the Pacific Ocean. In many places moraines do not extend beyond the front of the mountain range (see also Quilter and others, 1955).
Four advances of Neptome age have been distinguished in the Yentna and Kullikina valleys. Correlation of these advances in the Talkeetna quadrangle is based on moraine position and degree of modification. All drift of the Neptome Glaciation has been somewhat modified by slaving processes and superimposed various types of vegetation cover depending on physiographic setting and altitude. Drift of many small Neptome alpine glaciers that fed the larger glaciers has been modified by mass wasting, and assignment to one of the four advances is not possible.

- DRIFT OF KNIK GLACIATION**
Drift of the Knik Glaciation is exposed only in the northeastern part of the quadrangle where end and lateral moraines are well preserved. These deposits correlate with the Farewell Bend Glaciation in the Iliamna region (Karlstrom and others, 1964). Numerous kettle lakes are present behind the end moraines, and only the larger glaciers extended beyond the front of the mountain range.
On the south side of the Alaska Range large valley glaciers of Knik age coalesced in the lowland areas and extended as far south as the northern part of the Yentna quadrangle. Within this area deposits of the Knik Glaciation have been covered by the deposits of the Neptome Glaciation.
The Knik Glaciation has not been accurately dated by radiocarbon methods. Karlstrom (1960) estimated that the maximum advance took place between 30,000 and 65,000 years ago.

- DRIFT OF EKLUTNA GLACIATION**
Glacial deposits of Illinoian age in the Talkeetna quadrangle are represented by drift of the Eklutna Glaciation. Karlstrom (1960) estimated that this glaciation reached its maximum extent 90,000-110,000 years ago.
End and lateral moraines and knob-and-kettle topography of Eklutna age on the north side of the Alaska Range are moderately well preserved. The moraines probably correlate with those of the Selkirk Glaciation in the upper Kuskokwim region (Karlstrom and others, 1964). On the south side of the Alaska Range large valley glaciers coalesced with glaciers from the Talkeetna and Chugach-Kodiak areas to completely fill the Cook Inlet basin. Deposits of these large glaciers have been recognized in only a few areas, namely northwest of the Yentna Hills (T. 23 N., R. 11 W.), along the south side of the Peters Hills (T. 28 N., R. 8 W.), and south of the Tokosha Mountains (T. 30 N., R. 9 W.). These deposits include lateral and ground moraines that are greatly modified and covered by areas of muskeg and other vegetation.

- DRIFT OF PRE-ILLINOIAN AGE**
Subsided lateral(?) and ground moraines on the north side of the Alaska Range and glacial erratics and extensively modified drift on top of the Yentna Hills (T. 24 N., R. 11 W.) represent older Pleistocene glaciation in the Talkeetna quadrangle. This pre-Illinoian glaciation is correlative with glacial deposits at high altitude on Mount Sustina. These deposits, representing the Mount Sustina Glaciation (Karlstrom, 1960), are extensively modified by mass wasting. The rounded and subsided topography of many foothills along the south flank of the Alaska Range which were not covered by the younger glacial advances, is characteristic of areas covered by the pre-Illinoian glaciers.

- ALLUVIUM ON ACTIVE FLOOD PLAINS**
Extensive flood-plain alluvial deposits are most abundant on the south side of the Alaska Range, where unconsolidated glacial debris is being reworked and moved downstream. Many rivers such as the Yentna, the Kullikina, the Chulitna, and the Sustina have broad flood plains with low gradients. Braided channels are common near the headwaters of these rivers where sediment is being supplied at a rate faster than it can be removed. The lower reaches of the rivers are characterized by large meanders, oxbows, and back swamps. Water in all of the major rivers is silty or turbid from suspended glacial flour. The bulk of the material being deposited is sand and gravel, although boulders are common near headwaters of the larger rivers and streams.

- ALLUVIUM UNDIFFERENTIATED**
Material shown as alluvium undivided includes alluvial material above the alluvium of active flood plains, alluvial fan, alluvium of small active streams, alluvial deposits on broad pediment surfaces, and outwash from the Alaskan older glaciations. The unit consists of interstratified boulders, gravel and sand with local areas of silt and clay.
Alluvial deposits on the broad pediment surfaces north of the Alaska Range formed as alluvial fans and as flood-plain deposits. Glacial outwash from Illinoian and younger glaciations provided the material for these deposits.
Abundant alluvial fans in the Alaska Range have developed where streams with steep gradients discharge onto valley floors. These fans are generally less than 2 km in size. The largest alluvial fan (26 km²) observed on the south side of the Alaska Range is located 9 km west of Mt. Kistken (T. 26 N., R. 14 W.) where a southward-draining tributary of the East Fork of the Yentna River has formed a brush-covered alluvial fan that is now being dissected.

- South of the Alaska Range, much of the undivided alluvium is crudely stratified terrace deposits of gravel and sand which formed in both fluvial and lacustrine environments.

- FLUVIO-LACUSTRINE DEPOSITS**
Fluvio-lacustrine deposits of glacial origin occur in three areas in the quadrangle. Those in the Cache Creek area (T. 28 N., R. 9 W.) form a flat upland surface; those in the Alder Creek area (T. 31 N., R. 6 W.) and Dutch Creek (T. 29 N., R. 10 W.) occur as terraces. These deposits are characterized by little or no timber cover, a lack of glacial moraine features, and flat surfaces.
In the Cache Creek drainage, placer gold has been produced from (1) stream and bench gravels of Holocene age, (2) glacial deposits of Quaternary age, and (3) various conglomerate beds in the Kenai Group (Capps, 1913, 1921; Clark and Hawley, 1968) of Tertiary age. The locally coarse, angular nature of the gold and weakly mineralized gold-bearing veins indicate that at least some of the gold was locally derived. The following discussion of the influence of glaciation on the extensive deposits along Cache Creek applies equally to the Dutch Creek drainage basin. Similar glacial processes formed the fluvio-lacustrine deposits in Peters, Canyon, Granite, and Alder Creeks.

- During the late Miocene and Pliocene time placer gold was locally concentrated in lower clastic beds of the Kenai Group. During early Wisconsin time, glaciers covered most of the Dutch and Peters Hills, producing rounded topography and partly scouring the Cache Creek basin. Early in late Wisconsin time (early Neptome Glaciation) a large glacier occupied the Kullikina Valley, and the valley glaciers in the Dutch and Peters Hills scoured and partially filled the valley of Cache Creek. Although they apparently did not coalesce with the Kullikina Glacier. After these valley glaciers retreated the moraine debris was modified by melt water from both the valley glaciers and the high-standing Kullikina Glacier. The Kullikina then domed Cache Creek valley and changed the dominantly fluvial environment to a lacustrine environment.

- During the Fluvial episode, gold derived from the underlying Cretaceous and Tertiary formations was reworked and deposited in the basal part of Hidden Creek valley deposits. During the lacustrine episode, a sequence of glacially derived bluish-gray and accumulated in small ponds and lakes on top of the glacial deposits. After retreat of the glacier, Cache Creek was rejuvenated and cut a deep V-shaped canyon, leaving portions of the glacial deposits intact.
Fluvial and lacustrine deposits presently being deposited in Hidden Creek (T. 29 N., R. 10 W.) are considered to be modern analogs of the earlier glacial deposits formed in the Cache Creek and Peters Creek basins. The upper part of Hidden Creek valley is occupied by a small glacier that feeds Hidden Creek. The lower part of the valley is dammed by the Kullikina Glacier, and fluvial and lacustrine deposits are being deposited. If the Kullikina Glacier retreats above Hidden Creek valley, thus removing the ice dam, Hidden Creek will be rejuvenated and will cut a canyon, leaving the fluvio-lacustrine deposits as terraces. The deposits thus formed would be similar to those now exposed in Cache Creek.

- Karlstrom (1964) mapped a large area of proglacial lake deposits that occupied much of the Cook Inlet basin during the Knik and Neptome Glaciations. These deposits were shown extending into the southeastern part of the Talkeetna quadrangle along Moose and Koto Creeks (T. 23 N., R. 6 W.). But we could not recognize them on aerial photographs or satellite pictures. This area appears to be covered by swamp and fluvial deposits.

- LANDSLIDE DEPOSITS**
Landlides are spectacular products of mass movement in the quadrangle and consist of debris-avalanche and large block slides. The largest landslide complex, located near the terminus of the northeast-flowing glacier (T. 28 N., R. 18 W.), shows a history of multiple movement. Tustumena Stage moraine debris deposited on the slide indicates that part of the block slid before the Alaskan Glaciation. Later movement of smaller blocks near the valley floor has truncated the Tustumena lateral moraine. Large parts of the block slide complex south of the glacier are unexcavated. Slump-like slum blocks are separated by fractures up to 1.5 m wide and 7.0 m deep. Fracture walls are fresh and contain plant roots and clods of soil. Attached to a combined set of favorable circumstances such as high rain fall and earthquake tremors, could produce additional landlides. Block slides in Shalabager Pass (T. 28 N., R. 19 W.) and near the headwaters of the Billinger River are in Paleozoic sedimentary rocks. Seaford Limestone beds, 60 to 90 m thick, tended to remain intact during sliding, whereas less competent shales moved as a mud slurry.

- Debris-avalanche deposits are usually smaller in size than the block slides and occur in Cretaceous gravels and pyroclastic and Tertiary granite. Three large debris-avalanche deposits in the northeastern part of the quadrangle are in Tertiary granite and are aligned in a northeasterly direction. These deposits locally covered valley floors. The debris in these slides is composed of large angular blocks of granite up to 4.6 m on a side. These slides are not stable. A debris-avalanche deposit is on Coffee Creek (T. 31 N., R. 6 W.) and is at least 45 m thick. The absence of vegetation on the slide in Coffee Creek indicates that it is the youngest of the three. The alignment of the three slides, although parallel to the regional structure, is not related to any mapped faults.

- At the present time the areas of landlides are unpopulated, remote, and not easily accessible, and therefore pose no serious threat to people or property.

- COLLUVIUM UNDIFFERENTIATED**
Talus and outcrop rubble are shown as one unit on the map. Talus deposits are most common along the lower parts of valley walls and at the base of cirque headwalls. Accumulation of these deposits began after the retreat of the glaciers. Talus and many are actively forming. However, in the higher mountain areas they are continually being removed by glaciers. Some talus deposits are included with the rock glacier deposits because they provide the source material for the rock glaciers.

- Although outcrop rubble covers much of the flat to gently rounded hills on both flanks of the Alaska Range, only the larger and more extensive deposits are shown on the map. Many of these areas contain "islands" of ice-fractured bedrock. Outcrop rubble is more abundant in areas of sedimentary bedrock and in many places the deposits are inactive and covered with vegetation. Poorly to moderately well developed polygonal patterns occur locally in outcrop rubble. Polygons are generally 1 to 2 meters in diameter and contain cores (up to 15 cm) material near the margins and fine-grained soil-like material in the center. The polygonal patterns were observed on gently sloping to flat surface of ridge crests.

- ROCK GLACIERS**
More than 100 rock glaciers have been mapped, and others, too small to show at the scale of the map, are present in the Talkeetna quadrangle. Rock glaciers are both active (moving) and inactive (stationary). Active rock glaciers generally have steep fronts devoid of vegetation and a sharp angle between the front and upper surface of the glacier. Some override inactive rock glaciers. Surface features such as parallel ridges and furrows (generally convex down slope) are locally distinctive of active rock glaciers but are more subdued on inactive rock glaciers.

- Three types of rock glaciers are recognized: lobate (length less than width), tongue-shaped (length greater than width), and spatulate (enlarged lobate front). Lobate rock glaciers form at the base of cirque headwalls, and most are active. Tongue-shaped rock glaciers are the most abundant type and form along the upper parts of glacially carved valleys. Most are inactive, although some override brush-covered slopes. Spatulate rock glaciers are tongue-shaped rock glaciers that have moved beyond the confining parent valley and have developed a lobate fan at the fringes. Some large inactive rock glaciers such as in Happy Valley (T. 23 N., R. 18 W.) are of this type.

- The rock glaciers consist of poorly sorted angular debris derived from talus slopes of the bedrock and sedimentary bedrock. Similar deposits on the north side of the Alaska Range, the greatest concentration of rock glaciers is on the southern flank of the Alaska Range. The fronts of the rock glaciers occur between altitudes of 2,000 and 3,000 feet (600 and 1500 meters), the average being 3,000 feet. On the north side of the Alaska Range rock glaciers generally terminate at 5,000 feet (1500 m).

- SWAMP DEPOSITS**
Swamp deposits include small pond, bog and marsh deposits in the lowland area on the south side of the Alaska Range. Similar deposits on the north side of the Alaska Range are too small to show at the scale of the map. Swamp deposits occur in depressions in glaciated areas, along many of the major rivers and streams, and along mountain lakes. They are commonly referred to as muskeg. Karlstrom (1964) has measured thicknesses of 0.4 m to more than 6 m of organic silt and peat in bogs on the Cook Inlet lowlands. Berg and Cobb (1967) report that an actively forming bog iron deposit near Montana (T. 23 N., R. 8 W.) consists mainly of limonite and other hydrous iron minerals and is 15 m in diameter and 2.4 m in maximum thickness.

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SURFICIAL DEPOSITS MAP OF THE TALKEETNA QUADRANGLE, ALASKA

BY

STEVEN W. NELSON AND BRUCE L. REED